DRAFT TECHNICAL MEMORANDUM   **CH2M**HILL

GIS Coordination Plan — Upper Columbia River Site RI/FS

PREPARED FOR: Sally Thomas/USEPA
Kevin Rochlin/USEPA

PREPARED BY: Jesse Manley/SPK
Jim Stefanoff/SPK

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1.0 Introduction

Geographic information systems (GIS) are types of software that have the ability to create, analyze, query, display, and export many different formats of geographic or spatial data. GIS can be used for either small scale or large scale analysis. The true power of a GIS is found within the tools that it makes available to users. Before GIS became popular, people had to perform multiple time-consuming tasks and utilize many different types of software to get answers to their spatial questions. Modern GIS software offers a quick and efficient way to analyze, organize, and display a variety of data and information, providing high-quality answers for projects that involve analysis of a geographic area.

2.0 Rationale for Use of GIS

The Upper Columbia River Project is a large site with numerous geographic features. Many of these geographic features have been digitized, making them available for use as spatial datasets. Managing and tracking these multiple spatial datasets graphically through a GIS system is a logical and feasible way to analyze such a large area. As the project matures, GIS data sharing between various agencies will lead to better coordination and more efficiency. An example of this is the National Historic Preservation Act's Section 106, which requires that proposed sampling site locations must be provided to a historic preservation officer to determine if there is a potential to disturb historic and culturally significant sites. For the UCR project in particular, rather than researching each of the proposed sediment sampling sites, GIS can be used to quickly overlay these proposed sampling sites with historic and culturally significant areas. Adjustments to the proposed sampling sites can then be made, as needed. This helps to clearly identify potential areas of concern, reduces coordination time, enhances information exchange and promotes good working relationships between various agencies and stakeholders involved in the Upper Columbia River Project.

GIS offers a wide range of graphical and analytical tools that can calculate, overlay, extract, compare, and graphically display spatial data within the project site. In addition to graphical and analytical tools, GIS also offers an enterprise-style relational database management system (RDBMS) called a "geodatabase" that can store the entire body of Upper Columbia River Project GIS files under one database. The power of the geodatabase

is that it can create relationships between GIS files and it can be set up to allow multiple users to access, download, and even edit existing GIS datasets. Other important points about using GIS for the Upper Columbia River Project include the following:

- GIS excels at mapping locations, change over time, density, and statistical data

- GIS has the ability to link with and analyze data other than spatial data such as spreadsheets, databases, and imagery

- GIS analysis enables users to locate patterns and relationships within the GIS datasets

- GIS can quickly display and analyze different types of survey and GPS-based data

- GIS can be used to create quality graphics and maps

- GIS has the ability to format spatial datasets so they can be uploaded into a web-based server such as SIMS or ArcIMS

- GIS can create metadata (basic information and descriptions about spatial datasets) and export the metadata in a variety of formats

- Quality analysis, graphics, and information created by the GIS system gives users insight to project areas, help with choosing the best option, and assist with deciding on future courses of action

3.0 GIS Hardware and Software

ArcInfo 9.0 is the main GIS software that will be used for the Upper Columbia River Project. It is an ESRI product that consists of three modules: ArcMap, ArcCatalog, and ArcToolbox. This software provides almost all of the GIS functionality that will be needed for GIS analysis, processing, data conversion, data storage, and graphic display tasks. There are a wide variety of extensions available for this software, each catered to specific data needs. Users also can customize ArcInfo 9.0 to fit specific needs.

ArcInfo Workstation is another ESRI GIS software that will be used for the Upper Columbia River Project. This software is an older version of ArcInfo 9.0 that is a complete geoprocessing software package. ArcInfo Workstation is command-line based, which makes GIS tasks more time consuming, but it can run more complicated GIS tasks behind the scenes while other software is being used. ArcInfo Workstation is regarded by most GIS professionals as the fail-safe geoprocessing tool.

ArcSDE 9.0 acts as a translator for GIS and relational database management systems (RDBMSs). This ESRI software will be used to create and store our Upper Columbia River geodatabase on the EPA's Microsoft SQL server located in our Spokane office, as discussed later in this memorandum. ArcSDE 9.0 allows multiple users to access and store vast amounts of GIS data on commercial databases such as Oracle or Microsoft SQL Server. ArcSDE 9.0 also assists with configuring commercial databases to fit GIS needs. This software has its own classification scheme for file folders and files. It creates the overall geodatabase as a distinct database within the server, file folders within the geodatabase become feature datasets, and the actual GIS files become feature classes.

The Upper Columbia River Project also will use Autodesk's Mapguide 5.0 GIS software on CH2M HILL's SIMS interactive website. This software is ideal for providing web-based GIS tools and graphics to people with little or no GIS experience. Basically, Mapguide 5.0 is a GIS viewer with a limited supply of query, analysis, and display tools. This software also provides a link between the SIMS database and the Upper Columbia River's GIS files so users can create individually customized queries, reports, and figures.

The EPA has leased a DELL Power Edge 1750 server that has a total of 1.7 terabytes of storage space. This server is located in our Spokane office. This server (named BOO) is running Microsoft's SQL Server 200 SP3, ArcSDE 9.0, and Windows 2000 Server SP4 (service pack) with all Microsoft-recommended critical security patches. BOO is being backed up by BackupExec 9.1 Agent and BackupExec 9.1 SQL Agent. The BOO server will store all of the Upper Columbia River Project's GIS data.

4.0 GIS Data Acquisition Requirements

The current directory of project-specific, spatial datasets was downloaded for free from GIS data clearinghouse websites (WSDOT, WA DNR, WA Dept of Health, NPS, GIS Data Depot). The Bureau of Reclamation (USBR) Grand Coulee Power Office Planning Branch also provided much of the initial data related to the Lake Roosevelt area. Features for the Upper Columbia River, its major tributaries, and the river-mile locations were digitized off of 1:24000 USGS digital topographic maps. The majority of the infrastructure GIS data came with ArcGIS 9.0 as part of the software package.

In addition to United States GIS data, Canadian GIS data were downloaded from Canadian GIS data clearinghouse websites and some of it also came with ArcGIS 9.0. CH2M HILL's Spokane office also ordered a set of 1:50000 Canadian topographic maps that were used to digitize features in the Canadian stretch of the Upper Columbia River. The level of GIS-based geospatial coverage for features and attributes in Canada is much less than what is available on the U.S. side of the border.

All future data collection should use the 1937 USBR vertical datum and the NAD 83, State Plane, Washington North coordinate system, in order to maintain a consistent datum for managing and displaying project data. The GIS files for the future sampling sites will include X and Y coordinates and river-mile numbers. The attribute tables from these GIS files will be exported and compiled into a digital coordinate file that will be GPS-compatible.

Coordination of field data collection locations will be accomplished as follows:

- The sampling teams will regularly upload digital coordinate files into their GPS units before heading into the field.

- The sampling teams will attempt to locate the proposed sampling points as close as possible to the designated locations (within 50 feet or less) that are stored in the GPS units.

- Because there will be some inherent locational variance between the intended sampling points and the points where the samples are actually collected, the sampling teams will store the true and actual sample locations in their GPS units at the time of collection.

- The true and actual coordinates for the new sampling locations will then be sent to the GIS coordinator and uploaded into the Upper Columbia River geodatabase and SIMS.

5.0 Anticipated GIS Coordination Process and Outputs

Most of the GIS output and formats will be contingent on specific project and document needs. Requests for hard-copy maps and digital data will be coordinated with the CH2M HILL Spokane office GIS coordinator, Jesse Manley (509-623-1664, ext. 215, or e-mail at jmanley@ch2m.com). It is anticipated that the majority of the output will fall into the following categories:

- PDF files
- Coordinate files for sampling teams
- Shapefiles for data exchange
- ArcSDE 9.0-based geodatabase feature classes for the Upper Columbia River GIS
- Metadata files for all GIS files

6.0 Organizational Structure Used for GIS System

The geodatabase design breaks up the Upper Columbia River GIS into five ArcSDE feature datasets (or categories):

- Analysis
- Biological Impacts
- Infrastructure
- Miscellaneous Features
- Natural Features

Located within each ArcSDE feature dataset are the associated ArcSDE feature classes (i.e. roads under Infrastructure, rivers under Natural Features, etc.). In addition, each raster image file exists as individual ArcSDE raster datasets within the Upper Columbia River geodatabase. The figure below illustrates the actual geodatabase file structure.
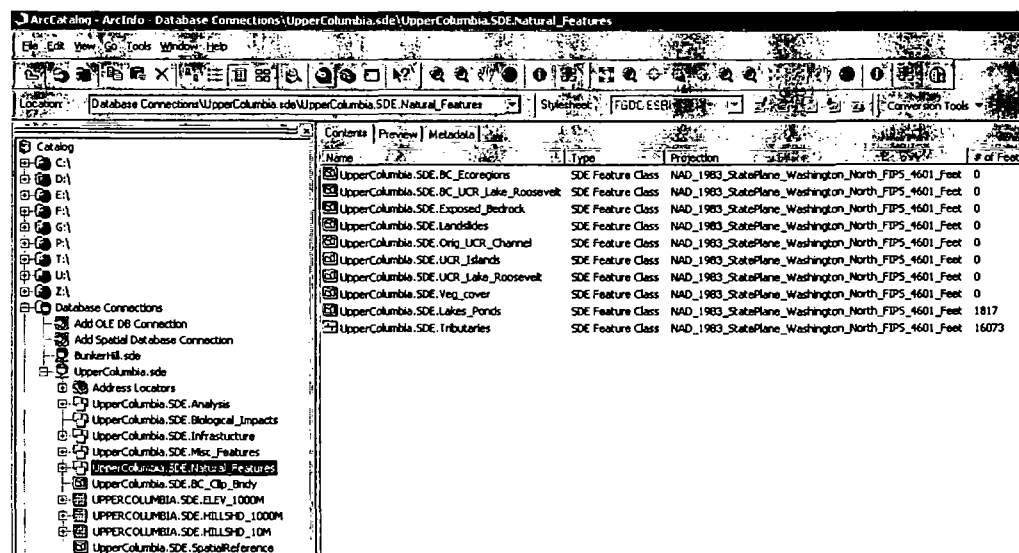
7.0 GIS Integration With SIMS

The majority of the Upper Columbia River GIS data will be uploaded into the SIMS website and periodically updated. Currently, these GIS files are exported as shapefiles and sent via CD by mail or ftp site to the SIMS managers in CH2M HILL's Santa Ana, California office. PDF versions of current GIS maps also are sent to the SIMS managers for use as a guide in setting up layers, symbology, etc. Past and future sampling data also will be loaded into SIMS and linked to the SIMS database so authorized users can create queries, reports, and figures. The metadata for each Upper Columbia River GIS file also will be accessible on the SIMS website through hyperlinks that are associated with each GIS file.

8.0 Future GIS Modifications or Enhancements

GIS will have an essential role throughout the duration of the Upper Columbia River Project. Routine upgrades of the GIS system can be anticipated over the life of the project as the GIS software evolves and system optimization measures are implemented. New GIS datasets will continue to be added, and existing ones modified as needed, in accordance with project needs. The GIS coordinator, working in conjunction with other GIS resources within CH2M HILL, IT support staff, and the project manager, will proactively identify necessary or desirable changes and upgrades that are deemed most suitable, beneficial, and cost-effective.